Verification of Translation

U.S Patent Application Serial No. 10/014,250

TITLE OF THE INVENTION:

POSITIVE ELECTRODE PLATE FOR ALKALINE STORAGE BATTERY AND METHOD FOR MANUFACTURING THE SAME, AND ALKALINE STORAGE BATTERY USING THE SAME

I, Yoshie HAGA, professional patent translator, whose full post office address is IKEUCHI·SATO & PARTNER PATENT ATTORNEYS, 26th Floor, OAP Tower 8–30, Tenmabashi 1–Chome, Kita–ku, Osaka–shi 530–6026, Japan, am the translator of the documents attached and I state that the following is a true translation to the best of my knowledge and belief of Japanese Patent Application No. H10–289713.

At Osaka, Japan
DATED this November 17, 2003

Signature of the translator

Yoshie Haga

Yoshie HAGA

MANUFACTURE OF PASTE-TYPE NICKEL ELECTRODE PLATE

[CLAIM]

[Claim 1] A manufacture of a paste-type nickel electrode plate, the method comprises: with a paste-like active material, filling a sponge-like metal porous body of a three-dimensional structure having spaces formed continuously; pressing the porous body with an emboss roller in a state where the paste-like active material has a moisture content of not more than 2 wt%, and further press-shaping with a flat roller.

[DETAILED DESCRIPTION OF THE INVENTION]

[0001]

[Technical field to which the invention pertains]

The present invention relates to a manufacture of a paste-type nickel electrode plate.

[0002]

[Prior art]

In a conventional method, this kind of paste-type nickel electrode plate is manufactured by filling a sponge-like metal porous body with a paste-like active material, and press-shaping either with a flat roller in a dried state (the paste-like active material has a moisture content of 0 wt%) or with an emboss roller in a half-dried state (the paste-like active material has a moisture content of about 10 wt% to 15 wt%).

[0003]

[Problem to be solved by the invention]

However, in the above-described conventional pressing with a flat roller in a dried state, a filling density of the active material is as low as about 600 mAh/cc. When the density is raised further, the electrode itself will be hardened and warped. In a case of pressing with an emboss roller in a half-dried state, the active material will have a filling density being as low as about 500 mAh/cc. The plate will be corrugated when pressed further.

[0004]

An object of the present invention is to provide a soft paste-type nickel electrode plate filled with an active material at a high density.

[0005]

[Means for solving problem]

For corresponding to the above-mentioned object, the present invention comprises: with a paste-like active material, filling a sponge-like

metal porous body of a three-dimensional structure having spaces formed continuously, subsequently pressing with an emboss roller in a state where the paste-like active material has a moisture content of not more than 2 wt%, and then press-shaping with a flat roller.

[0006]

The pressing is performed with an emboss surface, i.e., a surface having many asperities, particularly concavities formed continuously from the center area to the ends. As a result, air can escape easily from the center of the electrode substrate at the time of the pressing. By pressing this electrode substrate further with a flat roller, an electrode with a uniform density can be manufactured.

[0007]

[Mode for carrying out the invention]

The present invention will be explained below.

[0008]

(Example)

A sponge-like nickel metal porous body having a porosity of 95%, an average grid diameter of 50 microns and an average globular space of 350 microns was filled with a paste-like active material prepared by mixing 70 weight parts of a nickel hydroxide powder having an average particle diameter of 50 microns and 30 weight parts of 2 wt% aqueous solution of carboxymethyl-cellulose, and subsequently, the porous body was dried until the moisture content of the paste-like active material was reduced to 2 wt% or less, and then pressed at a pressure of 400 kg/cm^2 with an emboss roller provided with a grid-like groove 0.05 mm in depth and 0.5 mm in width. After the pressing with the emboss roller, the porous body was pressed similarly for shaping with a flat roller.

[0009]

(Comparative Example 1)

Electrode substrates filled with an active material paste similarly to Example were dried until the moisture contents of the entire paste-like active materials were reduced to 3, 5, 10 and 15 wt% respectively. Subsequently, the substrates were pressed for shaping with an emboss roller and a flat roller.

[0010]

(Comparative Example 2)

An electrode substrate filled with an active material paste similarly to Example was dried until the moisture content of the entire paste-like active material was reduced to 0 wt%. Subsequently, the substrate was pressed for shaping with an emboss roller and a flat roller.

[0011]

FIG. 1 shows a relationship between a filling density of an active material and a moisture content of an entire active material paste in an electrode plate. The filling density in FIG. 1 reaches its peak when the moisture content is 2 wt%, and it is lowered sharply when the moisture content exceeds 3 wt%. Here, the filling density was obtained by checking 50 electrode plates.

[0012]

(Comparative Example 3)

An electrode substrate filled with an active material paste and dried similarly to Example (moisture content was 2 wt% or less) was pressed for shaping with a flat roller.

[0013]

(Comparative Example 4)

An electrode substrate filled with an active material paste and dried similarly to Example (moisture content was 2 wt% or less) was pressed with a flat roller and subsequently pressed for shaping with an emboss roller.

[0014]

(Comparative Example 5)

An electrode substrate filled with an active material paste and dried similarly to Example (moisture content was 2 wt% or less) was pressed for shaping with an emboss roller.

[0015]

Table 1 shows filling densities of electrodes obtained respectively in Example and Comparative Examples 3-5, extension of electrodes after press-shaping, and short-circuit incidence at a time of winding spirally through a known paste-type cadmium pole and a separator. As clearly shown in Table 1, the electrode of Example has better performance than any of the Comparative Examples. Here, 50 electrode plates and 10,000 cells were used for the check. Extension (%) in Table 1 denotes (extension of electrode plate after pressing) / (electrode plate length before pressing). A higher extension indicates a smaller filling density.

[0016]

(Table 1)

Pressing	Filling density (mAh/cc)	Extension (%)	Short-circuit incidence (%)
Example	650	4.8	0.1
Comparative Example 3	640	5.1	10.0
Comparative Example 4	550	8.0	1.0
Comparative Example 5	510	8.0	1.0

[0017]

The electrode plate of Comparative Example 3 is extended less and its filling density is raised as high as that of Example. However, the electrode plate cannot be used practically for a cell, since it is hard and its short-circuit failure is increased.

[0018]

Though the electrode plates of Comparative Examples 4 and 5 have improved softness, they are extended greatly at a time of pressing, and thus the filling densities are not increased.

[0019]

[Effects of the invention]

As mentioned above, an electrode plate, which is obtained by pressing with an emboss roller in a state of having a moisture content of not more than 2 wt% and then by press-shaping with a flat roller, can have a high filling density in comparison with a conventional method of manufacturing a paste-type nickel electrode plate, i.e., the filling density can be raised up to about 650 mAh/cc. In addition, it is soft and difficult to cause a spiral short circuit, and thus it is most fitted for an electrode plate for a high-capacitance cell with a superior value from an industrial viewpoint.

[BRIEF DESCRIPTION OF THE DRAWING]

[Fig. 1]

The drawing shows a relationship between a moisture content of an electrode plate and a filling density.

[Explanation of letters and numerals]

None

Note: in FIG. 1, the x-axis indicates moisture content (wt%), and y-axis indicates a filling density (mAh/cc).